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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/648,317	08/27/2003	Ryo Kuroda	03560.003343	3665
5514	7590	05/03/2006	EXAMINER	
FITZPATRICK CELLA HARPER & SCINTO 30 ROCKEFELLER PLAZA NEW YORK, NY 10112			RUGGLES, JOHN S	
			ART UNIT	PAPER NUMBER
			1756	

DATE MAILED: 05/03/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/648,317	Applicant(s) KURODA ET AL.	
	Examiner John Ruggles	Art Unit 1756	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 4/24/06, 3/30/06, 3/7/06, & 1/27/06.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3-6,15 and 16 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 1,5 and 6 is/are allowed.
- 6) ☒ Claim(s) 3,4,15 and 16 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 07 March 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination (RCE) under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after allowance or after an Office action under *Ex Parte Quayle*, 25 USPQ 74, 453 O.G. 213 (Comm'r Pat. 1935). Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, prosecution in this application has been reopened pursuant to 37 CFR 1.114. Applicants' submissions filed on 1/27/06, 3/7/06, 3/30/06, and 4/24/06 have been entered.

In the most recent submission filed on 4/24/06, claims 1 and 4-6 remain as previously presented (after the examiner amendment for allowance authorized by a telephone interview with Jack Cubert on 1/4/06), claim 3 has been re-presented as previously amended on 11/14/05 (but without the previously agreed-upon examiner amendment in line 2 of "opening" (singular) to -- openings-- (plural)), all of claims 7-14 have now been cancelled, claim 15 remains as previously presented (after having been newly added on 3/30/06), and claim 16 is currently added as new. Therefore, only claims 1, 3-6, and 15-16 remain under consideration.

Information Disclosure Statement

The information disclosure statement (IDS) submitted on 1/27/06 (understood to be a copy of a previously filed, but unrecorded IDS on 12/3/03) has now been considered by the examiner, as amended to correct US "6,171,703" (wrong number for the Kuroda et al. 1/9/01 patent) to US ~~--6,171,703~~ 6,171,730-- (1/9/01, Kuroda et al., 430/5).

Drawings

The previous objection to Figure 10 in the previous Office action mailed on 1/12/06 is now withdrawn in view of Applicants' amendment to this drawing on 3/7/06.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 3-4 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 3 line 2, it is unclear to which of the plural second slit openings in claim 1 line 8 (on which claim 3 depends) the phrase "said second slit opening" (singular) is meant to refer. However, for the purpose of this Office action, this phrase in claim 3 line 2 is interpreted to mean --said second slit openings-- (plural) (this change was previously indicated on page 5 in the examiner amendment section of the Office action mailed on 1/12/06, but was apparently overlooked by Applicants). Claim 4 depends on claim 3.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Art Unit: 1756

Claims 15-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over either Kuroda et al. (US Patent 6,171,730) or Kuroda et al. (US Patent 6,187,482) in view of Ebbesen et al. (US Patent 6,236,033) and/or Alkaisi, M. M. et al., ("Sub-diffraction-limited patterning using evanescent near-field optical lithography", (1999) Applied Physics Letters).

Kuroda et al. '730 teach a near field evanescent light exposure process and a near field exposure apparatus that includes a near field mask having an opaque shading layer with aperture widths of about 100 nm or less (title, abstract), but preferably in the range of 1-100 nm, as shown by Figures 2A and 2B (col. 5 line 41 to col. 6 line 40). Figure 2A shows rectangular block form L-shaped slit openings in the opaque shading layer on the near field mask, but any desired pattern of slit openings such as S-shaped slit openings or the like are also contemplated (col. 6 lines 40-42). Figures 8A and 8B show a near field mask having rectangular block form L-shaped slit openings of different widths in the opaque shading layer, but the shape, width, length, and size of the slit openings are not limited so that any desired shape can be selected, such as specifically contemplated S-shaped slit openings (col. 13 lines 12-15). In Figure 8A, the width of the light shading layer portion between adjacent parallel first slit openings appears to be equal to the width of perpendicular second slit openings and this relationship is further contemplated to also be preserved for alternative S-shaped slit openings. The near field exposure apparatus shown by Figure 1A includes a collimator lens 103 to conform exposure light from the light source into parallel light beams 102 for exposure through the near field mask 106 (col. 3 line 45 to col. 4 line 10).

Kuroda et al. '482 teach a near field mask for evanescent light exposure and an apparatus for making a pattern using the near field mask (title, abstract). The mask includes a transparent

Art Unit: 1756

base or substrate 201 and a metallic thin film shading member 203 having minute apertures 204, each having a width < 100 nm, which is small in comparison with the wavelength of exposure light (abstract, Figure 2, col. 4 lines 49-54). The width of the apertures is specifically stated to be less than the wavelength of exposure light (col. 7 lines 61-62). Figure 3A shows hook-shaped (rectangular block form L-shaped) slit openings 303 less than 100 nm wide in the opaque shading layer on the near field mask, but there is no limit on length and the patterns can be selected freely in this direction, such as specifically contemplated alternative S-shaped slit openings (col. 7 line 13 to col. 8 line 15). Also in Figure 3A, the width of the light shading layer portion between adjacent parallel first slit openings appears to be equal to the width of perpendicular second slit openings and this relationship is further contemplated to also be preserved for alternative S-shaped slit openings. The exposure apparatus shown by Figure 1 includes a collimator lens 103 to conform exposure light from the light source 101 into parallel light beams 102 for exposure through the near field mask 106 of a resist 107 (col. 4 lines 1-45).

Neither Kuroda et al. '730 nor Kuroda et al. '482 specifically teach *[1]* a near field mask having a light shielding film with two or more first slit openings lengthening in a first direction that are interlinked by a second slit opening lengthening in a second direction and *[2]* inclusion of a light illuminating means for illuminating polarized light along the first direction parallel to the first slit openings of the near-field mask in the near-field exposure apparatus (instant claims 15-16).

Ebbesen et al. teach enhanced optical transmission apparatus utilizing metal films having apertures (title) for various applications, including near-field optical devices and masks for sub-wavelength photolithography (abstract, col. 2 lines 27-28). Figure 17A shows a mask having a

Art Unit: 1756

metal blocking layer with an H-shaped opening made up of first parallel slit openings connected by a perpendicular interlinking second slit opening for exposure of a resist (col. 15 lines 25-30). The exposure wavelength is much greater than the size of apertures or the width of slit openings (124a, col. 15 lines 18-20, even to the extent that the ratio of slit opening width to the exposure wavelength can be as small as about 0.1, col. 2 lines 61-67) and this exposure wavelength is described to come from a "regular UV light source" instead of a deep-UV source (col. 15 lines 40-42, which is understood to mean that the exposure wavelength is in the range of 300 nm to 400 nm). Therefore, the slit opening width can be as small as 0.1 times the exposure wavelength or about 30 nm to 40 nm. When the incident exposure light is "p-polarized" to have an electric field parallel to the x-axis while the metal film is rotated about the y-axis through an angle θ as shown by Figure 7, the coupling of light with surface plasmons on the metal surface with any periodic structure (such as a periodic surface topography or a periodic array of apertures or slit openings) follows momentum conservation (col. 9 lines 23-30). The beneficial increase in photon energy or light intensity for the metal surface having periodic structures is shown by Figure 8B in comparison to Figure 8A for the metal surface without periodic structures (col. 10 lines 1-7).

As discussed above, Ebbesen et al. teach a beneficial increase in light intensity for exposure of a resist when the incident exposure light is polarized to have an electric field parallel to the x-axis of a mask having periodic structures and an H-shaped opening made up of first parallel slit openings connected by a perpendicular interlinking second slit opening.

Alkaisi et al. teach clear and faithful reproduction through a near-field mask having rectangular apertures or slit openings that are 70 nm wide (which is $< 1/5$ times the wavelength

Art Unit: 1756

of incident light). High transmission (intensity of transmitted light) through the mask slit openings is always achieved for at least one polarization of incident light through the near-field mask as shown by Figure 2(b) (page 3561, left col., fourth full paragraph). Polarization of incident light in the direction perpendicular to the mask slit apertures (for transverse magnetic (TM) polarization) results in high light transmission through the mask slit apertures to expose a resolved pattern in the top 40 nm of the resist layer (as shown in Figure 3(a) on page 3562, left col., last paragraph), whereas polarization of incident light in the direction parallel to the mask slit openings (for transverse electric (TE) polarization) does not result in a clearly resolved pattern to any depth in the resist layer (as shown in Figure 3(b) on page 3562, right col., lines 1-4). Thus, exposure of the resist will be dominated by the well-resolved, high-intensity TM profile (page 3562, right col., lines 4-7).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have included a light polarizer to direct illumination light along a particular direction with regard to slit openings in the near field mask (as taught by Ebbesen et al.) in the near-field exposure apparatus (as taught by either Kuroda et al. '730 or Kuroda et al. '482) in order to achieve a beneficial increase in light intensity for directional exposure of a resist through the mask pattern (as taught by Ebbesen et al.). Also, it would have been obvious in the near field exposure apparatus taught by either Kuroda et al. '730 or Kuroda et al. '482 to have included a light polarizer to direct illumination light perpendicular to a second slit opening in a second direction that interlinks two first slit openings in a first direction in the near-field mask (particularly when it is desirable to selectively expose the resist by near field exposure through a mask as taught by Alkaisi et al. and the mask has openings in first and second directions that are

Art Unit: 1756

approximately perpendicular to each other, e.g., for an H-shaped opening pattern on a near field mask, etc., as taught by Ebbesen et al.) in the near-field exposure apparatus using a near-field mask having parallel first slit openings interlinked by a perpendicular second slit opening. This is because Alkaisi et al. teach that exposure of the resist will be dominated by a well-resolved, high-intensity profile of the near-field mask slit openings running in a direction that is perpendicular to the direction of polarized incident light. Thus, in the near-field mask exposure using a near-field mask having parallel first slit openings running in a first direction interlinked by a perpendicular second slit opening running in a second direction, the resulting resist image would be expected to be dominated by stronger exposure through the second slit opening without exposure through the first slit openings, when the incident light is polarized in a direction parallel to the first slit openings and perpendicular to the second slit openings (as taught by Alkaisi et al. in combination with either Kuroda et al. '730 or Kuroda et al. '482 and Ebbesen et al., [1], [2]).

Allowable Subject Matter

Claims 1 and 5-6 are allowed.

The following is an examiner's statement of reasons for allowance: the prior art does not specifically teach all the limitations of claim 1. In particular, the prior art does not specifically teach a near-field photomask comprising a light shield film with patterned openings that comprise two or more parallel rows of first slit openings each having a width smaller than 100 nm and two or more parallel rows of second slit openings each having a width smaller than 100 nm, in which the two or more parallel rows of second slit openings extend perpendicularly to the two or more parallel rows of first slit openings, comprising means for forming a plurality of discrete, spaced apart latent-dot-image formed areas, spaced apart from each other along two

Art Unit: 1756

perpendicular directions on an exposure target in response to each of the first and second slit openings receiving polarized light having an electric field component parallel to the two or more parallel rows of first slit openings. Therefore, claim 1 is allowable over the prior art and claims 5-6 are also allowable over the prior art (due to their dependence on claim 1).

Claims 3-4 would also be allowable if claim 3 were rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims. Claim 4 depends on claim 3.

Response to Arguments

The information disclosure statement (IDS) submitted on 1/27/06 has been considered with the change noted above.

The previous objection to Figure 10 has been withdrawn in view of Applicants' amendment to this drawing on 3/7/06, as indicated above.

Claims 3-4 have been rejected under 35 U.S.C. 112, second paragraph, as set forth above.

Claims 1 and 5-6 are allowed, for the same reasons as previously stated and again repeated above. Claims 3-4 would also be allowable if claim 3 were rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, and to include all of the limitations of the base claim and any intervening claims.

Applicants' arguments with respect to claims 15-16 have been considered, but are moot in view of very similar ground(s) of rejection over the same art of record as set forth in a prior Office action, which have been rewritten as necessitated by Applicants' current amendments and could have been made final if these claims were presented earlier.

Conclusion

All claims are drawn to the same or similar invention as claimed in the application prior to the entry of the submission under 37 CFR 1.114 and could have been finally rejected on the grounds and art of record in the next Office action if they had been entered in the application prior to entry under 37 CFR 1.114. Accordingly, **THIS ACTION IS MADE FINAL** even though it is a first action after the filing of a request for continued examination (RCE) and the submission under 37 CFR 1.114. See MPEP § 706.07(b). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.


Any inquiry concerning this communication or earlier communications from the examiner should be directed to John Ruggles whose telephone number is 571-272-1390. The examiner can normally be reached on Monday-Thursday and alternate Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 1756

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

John Ruggles
Examiner
Art Unit 1756



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PRIMARY EXAMINER
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